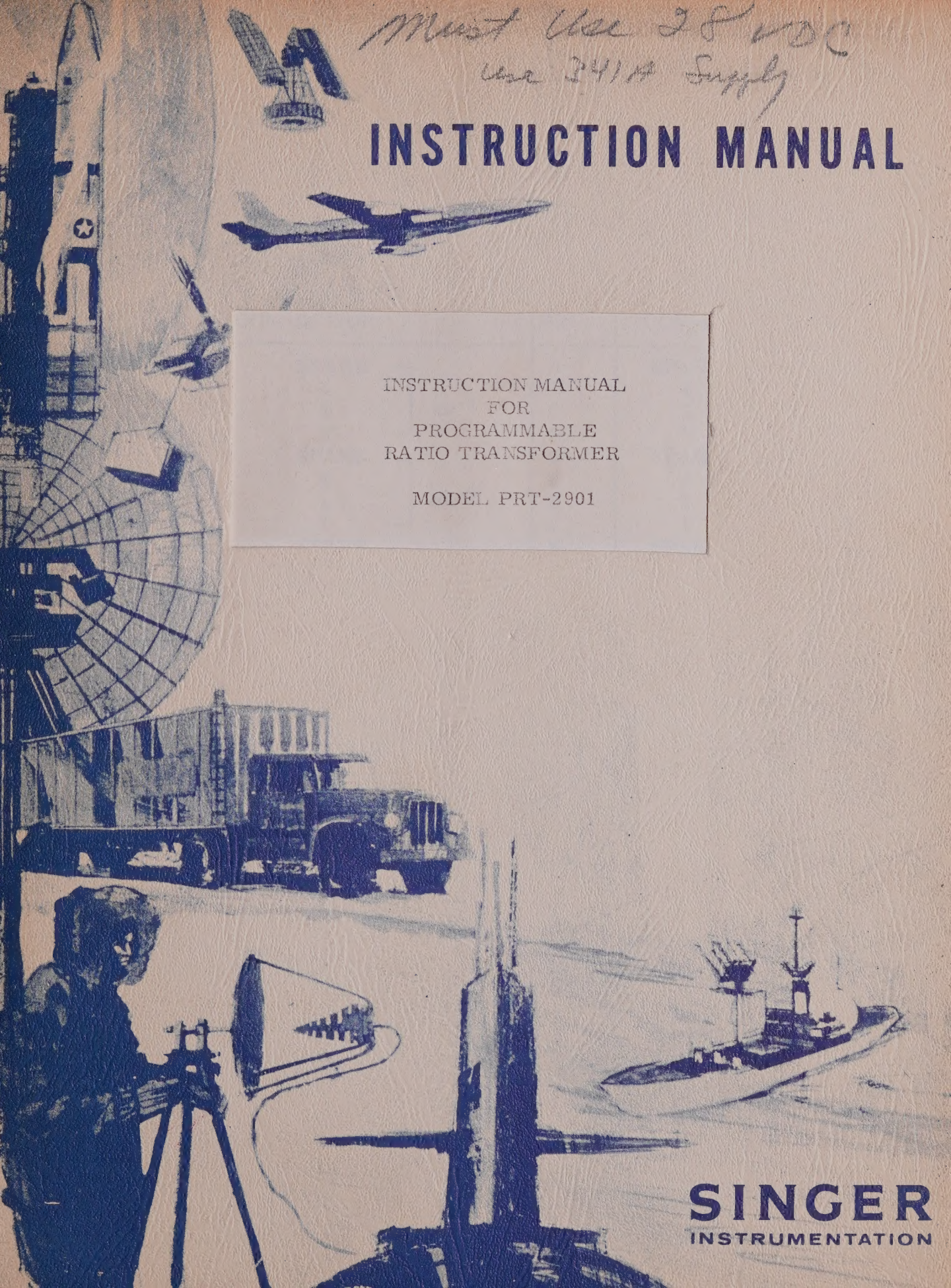
Must Use 28 VDC
Use 3411 Supply

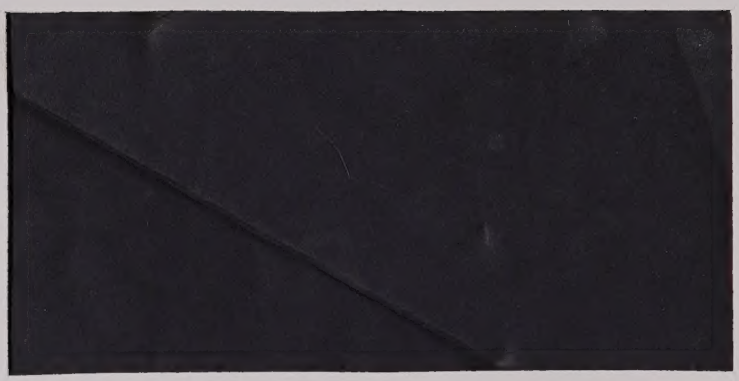
INSTRUCTION MANUAL



INSTRUCTION MANUAL
FOR
PROGRAMMABLE
RATIO TRANSFORMER

MODEL PRT-2901

SINGER
INSTRUMENTATION



INSTRUCTION MANUAL
FOR
PROGRAMMABLE
RATIO TRANSFORMER

MODEL PRT-2901

This document should be inserted into the front of the Model PRT Series Instruction Manual No. 1-500783-007 (Rev. A).

APPROVED | REVISED

This document provides additions, deletions and corrections to the Model PRT Series Instruction Manual No. 1-500783-007 (Rev. A) for conversion to a Model PRT-2901 Instruction Manual. The Model PRT-2901 is similar to the Model PRT-0-50220 (refer to page 1-2 of the manual).

Perform the following changes to the above manual.

Page 2-2. TABLE 2-2. PIN CONNECTORS, OCTAL UNITS

Replace Table 2-1 with the following table:

SIGNAL CONNECTOR (J1) MRE-34P-J6			INDICATOR-LATCH CONNECTOR (J2) MRE-34S-J6		
PIN	CONNECTION		PIN	CONNECTION	
A	SPARE		A	SPARE	
B	4		B	4	
C	2	$X8^{-1}$	C	2	$X8^{-1}$
D	1		D	1	
E	SPARE		E	SPARE	
F	4		F	4	
H	2	$X8^{-2}$	H	2	$X8^{-2}$
J	1		J	1	
K	SPARE		K	SPARE	
L	4		L	4	
M	2	$X8^{-3}$	M	2	$X8^{-3}$
N	1		N	1	
P	SPARE		P	SPARE	
R	4		R	4	
S	2	$X8^{-4}$	S	2	$X8^{-4}$
T	1		T	1	
U	SPARE		U	SPARE	
V	4		V	4	
W	2	$X8^{-5}$	W	2	$X8^{-5}$
X	1		X	1	
Y	SPARE		Y	SPARE	
Z	SPARE		Z	SPARE	
AA	SPARE		AA	SPARE	
BB	.25 RATIO		BB	SPARE	
CC	PHASE (180°)	0 V	CC	180°	
DD	SPARE	0 V	DD	SPARE	
EE	UN-LATCH	0 V	EE	0°	
FF	LATCH COMMON	0 V	FF	V1	
HH	INPUT HI		HH	SPARE	
JJ	INPUT LO		JJ	SPARE	
KK	OUTPUT HI		KK	SPARE	
LL	OUTPUT LO		LL	SPARE	
MM	CASE GRD		MM	SPARE	
NN	RELAY COMMON(+28V)		NN	LATCH COMMON 0 V	

REVISED

APPROVED

Page 4-3: Figure 4-4. Interconnection Diagram, Octal Units
Replace with the attached Figure 4-4.

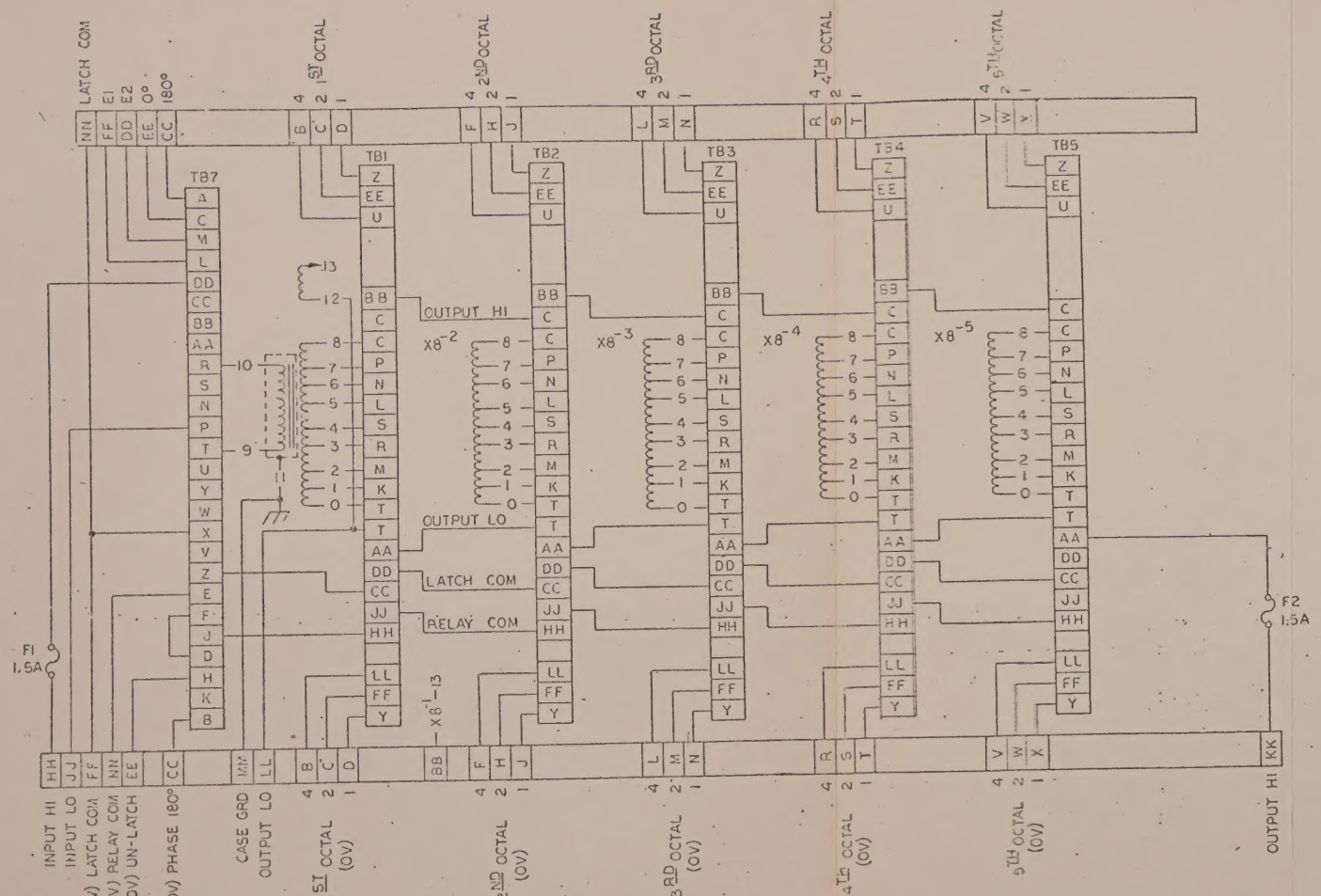


Figure 4-4, Interconnection Diagram, Octal Units. Dwg. No. 3-501392-001.

DIFFERENCE DATA SHEET
MODEL PRT-2901
Dwg. No. 1-410288-001
Sheet 4 of 4

INSTRUCTION MANUAL
FOR
PROGRAMMABLE
RATIO TRANSFORMERS
MODEL PRT SERIES

MANUAL NO. 1–500783–007 (Rev. A)

First Printing 6/67
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Rev A. 4/72 (incorporates addendum No. 1)

MANUAL CHANGES
SEE ADDENDUM(S) AT
REAR OF THIS MANUAL

SINGER
INSTRUMENTATION

The Singer Company, Los Angeles Operation • 3211 South La Cienega Blvd., Los Angeles, Ca. 90016

WARRANTY

SINGER INSTRUMENTATION, LOS ANGELES OPERATION, (SELLER) warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

TCXO Oscillator	2 Years
Electrical and Electronic Measuring Instruments	1 Year

Repair or replacement (at our option) without charge (F.O B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuses, lamps, thermoelements, and RatioTran potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

If the instrument or any portion thereof, has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

This warranty is in lieu of all other warranties, express or implied INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY, or fitness for a particular purpose. In no event shall the SELLER be liable for INCIDENTAL OR CONSEQUENTIAL damages. The SELLER neither assumes, nor authorizes any person to assume for it, any other liability in connection with sales of instruments manufactured by SELLER.

With respect to repairs, the foregoing warranty shall apply for a period of ninety days to the repaired portion.

THE SINGER COMPANY, LOS ANGELES INSTRUMENTATION OPERATION
3211 South La Cienega Boulevard, Los Angeles, California 90016

REPAIR AND MAINTENANCE

Instruments should be returned only on prior authorization from the Singer Representative or the factory. You will be advised of detailed shipping instructions at that time. Return the instrument to the factory Prepaid. Validity of warranty will be determined by the factory.

Chargeable repairs: If requested, an estimate of charges will be made prior to repairs. Please provide us with the following information in order to expedite the processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(1)
4. Approximate date instrument was placed in operation.
5. Approximate number of hours in use.
6. Has maintenance action been previously requested.
7. Other comments.

(1) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken and any other relevant data.

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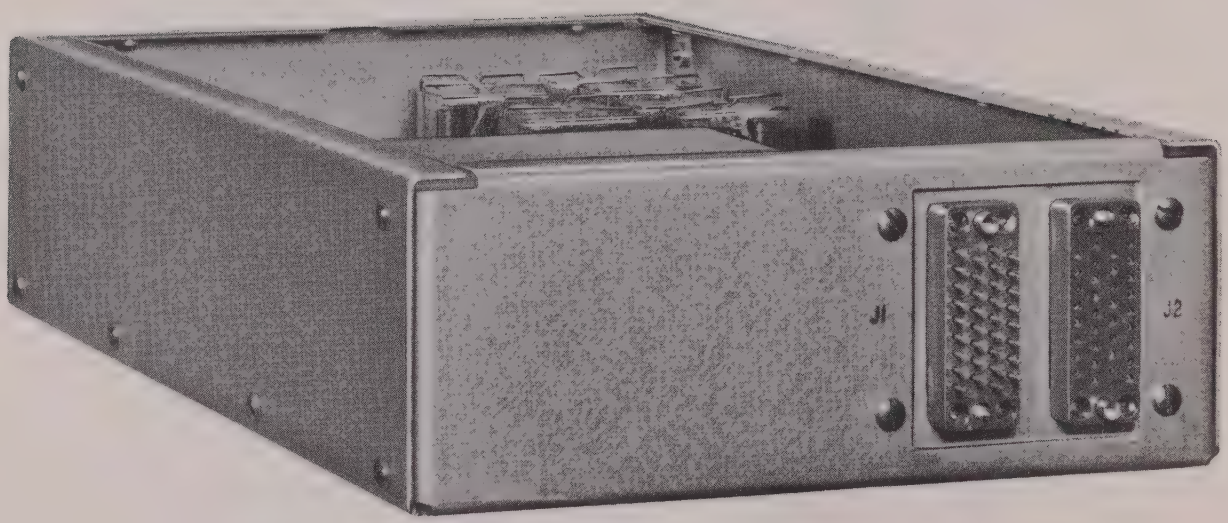


Figure 1-1. Model PRT Programmable Ratio Transformer

SECTION I
GENERAL DESCRIPTION

1-1. PURPOSE.

1-2. The model PRT programmable RatioTran is an audio frequency, inductive voltage divider which provides an output voltage with a precise ratio to an input voltage. The RatioTran receives a parallel digital input to establish the output ratio.

1-3. DESCRIPTION.

1-4. All components are housed within a metal case, equipped with removable dust covers. The unit is designed for remote control only. Therefore all control signals, the input reference voltage and the output ratio voltage are supplied through an electrical connector. (See table 2-1.)

1-5. The ratio is based on the use of a toroidal transformer and is not affected by age or environmental conditions. When driven by a constant voltage source, the internal impedance of the unit is low. A high input impedance allows use under a variety of test setups.

1-6. OPERATION. The RatioTran consists of a series of tapped transformer windings and selection relays. A portion of the input voltage is selected from the tapped windings by the relays. These portions are added together to form the output voltage.

1-7. ACCURACIES UNDER LOAD CONDITIONS. While the RatioTran is designed for maximum accuracy in the unloaded condition, reasonable loads may be applied. The resulting accuracy is a function of the load and the output impedance of the transformer. With reference to the equivalent circuit we see an ideal transformer with a series impedance (Ls and Rs) inserted in the output arm. The series impedance is due to leakage inductance, wiring resistance and other stray circuit elements. Ls and Rs vary with the ratio setting but only the maximum value is specified. From Rs and Ls the effect of loading upon the transformer accuracy can be calculated. The resulting loading error must be added to the no load ratio accuracy of the ideal transformer to obtain the accuracy at the output terminals.

1-8. MODEL SELECTION.

1-9. The various models are shown in table 1-2. For a fuller description of the electrical variations, refer to Section IV.

a. The typical relay tree for a decade model is shown in figure 4-2. The typical relay tree for an octal model is shown in figure 4-5.

b. The special features are shown in figures 4-7 through 4-12.

c. The patching variations are shown in figure 4-13.

TABLE 1-1. SPECIFICATIONS

FREQUENCY RANGE	50 - 10,000 HZ
MAX RMS INPUT VOLTAGE	0.35f (f in HZ) or 350 volts, whichever is less
RATIO RANGE	Zero to Unity
TERMINAL LINEARITY AT 400 HZ	
Direct or Isolated Units	± 2 ppm of input
RATIO ACCURACY AT 400 HZ	
Isolated Units	± (.003 + .0002/R) % of indicated ratio
MAX EFFECTIVE SERIES IMPEDANCE	
Direct Units	4 ohm + 75 uh
Isolated Units	40 ohm + 3.5 mh
INPUT IMPEDANCE AT 20V - 400 HZ	
Direct Units	150K min
Isolated Units	150K min
RELAY DATA	
Response Time	30 milliseconds (max)
Operating Voltage	22-31 vdc
Impedance	430 ohms (-10% min) at 25°C
Current/Bit	62 ma (max) at 24 vdc at 25°C
Pull In	18 v (max)
Drop Out	1.8 v (min)

TABLE 1-2. MODELS

P RT A B C

PROGRAMMABLE

RATIOTRAN

CODING
- O Straight Binary Code (Octals)
- D BCD (Decades)

RESOLUTION
- 3 Octal (2^9)
- 3 Decade (.1%)
- 4 Octal (2^{12})
- 4 Decade (.01%)
- 5 Octal (2^{15})
- 5 Decade (.001%)
- 6 Octal (2^{18})
- 6 Decade (.0001%)

RELAY COMMON VOLTAGE
- 0 +28 vdc
- 1 -28 vdc

LATCHING — D

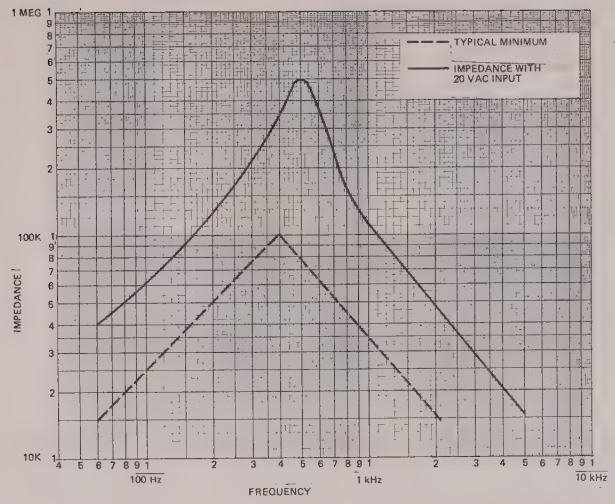
0 Latching	No Indicator Connections	No Delatch Relay
1 Latching	No Indicator Connections	Delatch Relay
2 Latching	Indicator Connections	Delatch Relay
3 No Latching	No Indicator Connections	No Delatch Relay
4 No Latching	Indicator Connections	No Delatch Relay

SPECIAL FEATURES — E

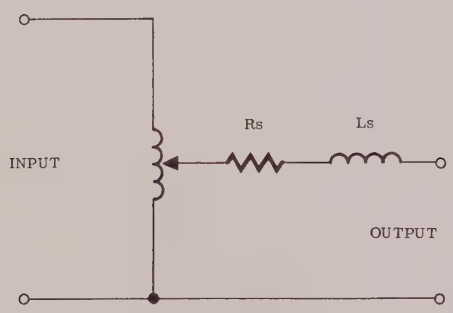
0 Direct Input	No Phase Inversion	No Voltage Selection
1 Isolated Input	No Phase Inversion	No Voltage Selection
2 Isolated Input	Phase Inversion	No Voltage Selection
3 Isolated Input	Phase Inversion	Voltage Selection (100:100, 100:10)
4 Isolated Input	Phase Inversion	Voltage Selection (115:115, 115:28)
5 Isolated Input	Phase Inversion	Voltage Selection (115:115, 115:100)

MOUNTING — 0
- 0 Full Rack (See figure 2-1)
- 1 Half Rack (See figure 2-2)
- 2 Front (See figure 2-3)
- 3 Side (See figure 2-4)

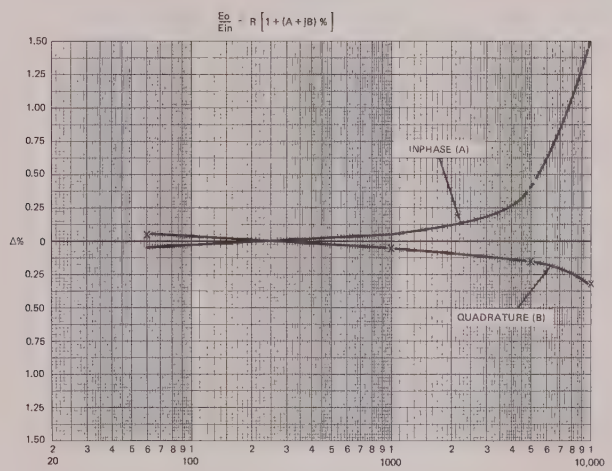
EXAMPLE: PRT-D-30212 is a programmable RatioTran with 3 decades, a +28 vdc relay common voltage, contacts which may serve a dual latching and external indication function, an isolated input, and front mounting.



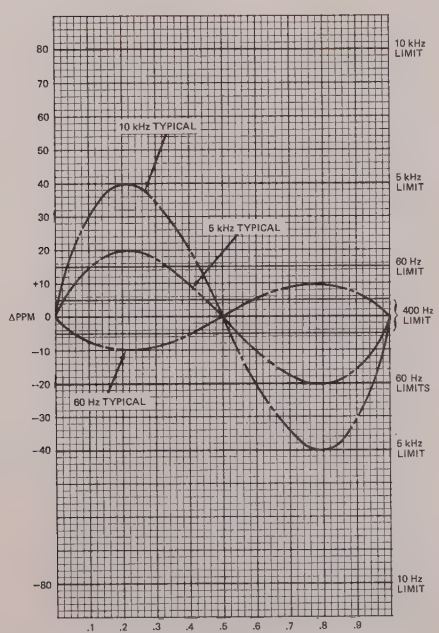
Input Impedance, Direct Mode



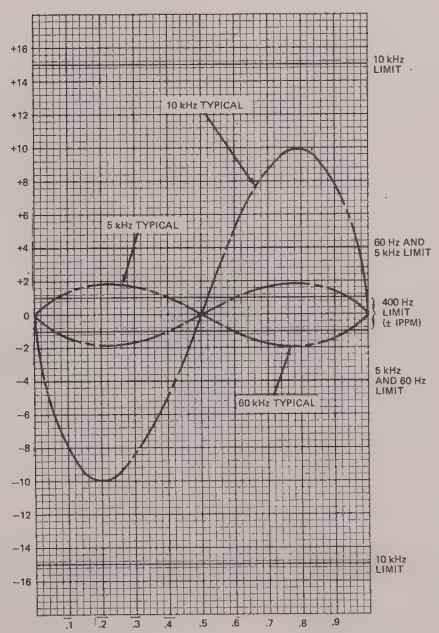
Equivalent Circuit



Error, Isolated Units



Inphase Ratio Error, PPM of Input Direct Units


10 kHz LIMIT
10 kHz TYPICAL
5 kHz TYPICAL
60 Hz AND 5 kHz LIMIT
400 Hz LIMIT (± IPPM)
5 kHz AND 60 Hz LIMIT
60 kHz TYPICAL
10 kHz LIMIT

Quadrature Ratio Error PPM of Input Direct Units

SECTION II
INSTALLATION

2-1. UNPACKING.

2-2. No special handling or unpacking procedures are required. After unpacking, inspect unit for any evidence of damage.

2-3. MOUNTING.

2-4. The unit is designed to be mounted with four screws (see figure 2-1). No other mounting is required.

TABLE 2-1. PIN CONNECTIONS, DECADE UNITS

SIGNAL CONNECTOR (J1) MRE-34P-J6

PIN	CONNECTION	NOTES
A	8	
B	4	$X10^{-1}$
C	2	
D	1	
E	8	
F	4	$X10^{-2}$
H	2	
J	1	
K	8	
L	4	$X10^{-3}$
M	2	
N	1	
P	8	
R	4	$X10^{-4}$
S	2	
T	1	A
U	8	
V	4	$X10^{-5}$
W	2	
X	1	B
Y	8	
Z	4	$X10^{-6}$
AA	2	
BB	1	C
CC	PHASE (180°)	D
DD	VOLTAGE	E
EE	UN-LATCH	F
FF	LATCH COMMON	
HH	INPUT HI	
JJ	INPUT LO	
KK	OUTPUT HI	
LL	OUTPUT LO	H
MM	CASE GRD	
NN	RELAY COMMON	

INDICATOR-LATCH CONNECTOR (J2) MRE-34S-J6 (NOTE G)

PIN	CONNECTION	NOTES
A	8	
B	4	$X10^{-1}$
C	2	
D	1	
E	8	
F	4	$X10^{-2}$
H	2	
J	1	
K	8	
L	4	$X10^{-3}$
M	2	
N	1	
P	8	
R	4	$X10^{-4}$
S	2	
T	1	A
U	8	
V	4	$X10^{-5}$
W	2	
X	1	B
Y	8	
Z	4	$X10^{-6}$
AA	2	
BB	1	C
CC	180°	D
DD	V2	E
EE	0°	D
FF	V1	E
HH	SPARE	
JJ	SPARE	
KK	SPARE	
LL	SPARE	
MM	SPARE	
NN	LATCH COMMON	

NOTES:

A. Not used on 3 decade units.
B. Not used on 4 (or less) decade units.
C. Not used on 5 (or less) decade units.
D. Used only on units equipped with phase inversion.
E. Used only on units equipped with voltage selection.
F. Used only on units equipped with delatch relay.
G. May be omitted.
H. Output LO used on isolated units only.

2-5. ELECTRICAL CONNECTIONS.

2-6. Refer to table 2-1 for the pin connections as a decade unit (1, 2, 4, 8, BCD PROGRAM) or to table 2-2 for an octal unit (1, 2, 4, STRAIGHT binary program). Mating connector for J1 is Winchester Part No. MRE-34S-J6. Mating connector for J2 is Winchester Part No. MRE-34P-J6.

2-7. INSTALLATION CHECKOUT.

2-8. Refer to section VI for an installation checkout procedure.

TABLE 2-2. PIN CONNECTIONS, OCTAL UNITS

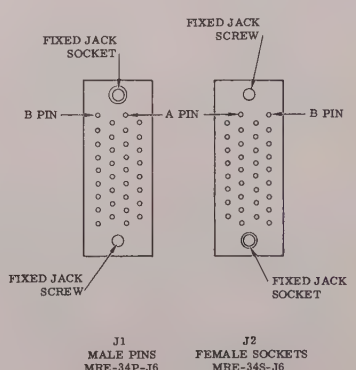
SIGNAL CONNECTOR (J1) MRE-34P-J6

PIN	CONNECTION	NOTES
B	Bit 1 (.500)	
C	Bit 2 (.250) 1st Octal	
D	Bit 3 (.125)	
F	Bit 4 (.0625)	
H	Bit 5 (.031250) 2nd Octal	
J	Bit 6 (.015625)	
L	Bit 7 (.0078125)	
M	Bit 8 (.00390625) 3rd Octal	
N	Bit 9 (.00195312)	
R	Bit 10 (.00097656)	
S	Bit 11 (.00048828) 4th Octal	A
T	Bit 12 (.00024414)	
V	Bit 13 (.00012207)	
W	Bit 14 (.00006104) 5th Octal	B
X	Bit 15 (.00003052)	
Z	Bit 16 (.00001526)	
AA	Bit 17 (.00000763) 6th Octal	C
BB	Bit 18 (.00000381)	
CC	PHASE (180°)	D
DD	VOLTAGE	E
EE	UN-LATCH	F
FF	LATCH COMMON	
HH	INPUT HI	
JJ	INPUT LO	
KK	OUTPUT HI	
LL	OUTPUT LO	H
MM	CASE GRD	
NN	RELAY COMMON	

INDICATOR-LATCH CONNECTOR (J2) MRE-34S-J6 (NOTE G)

PIN	CONNECTION	NOTES
B	Bit 1	
C	Bit 2	
D	Bit 3	
F	Bit 4	
H	Bit 5	
J	Bit 6	
L	Bit 7	
M	Bit 8	
N	Bit 9	
R	Bit 10	
S	Bit 11	
T	Bit 12	
V	Bit 13	
W	Bit 14	
X	Bit 15	
Z	Bit 16	
AA	Bit 17	
BB	Bit 18	
CC	180°	D
DD	V2	E
EE	0°	D
FF	V1	E
HH	SPARE	
JJ	SPARE	
KK	SPARE	
LL	SPARE	
MM	SPARE	
NN	LATCH COMMON	

NOTES:
- A. Not used on 3 octal units.
- B. Not used on 4 (or less) octal units.
- C. Not used on 5 (or less) octal units.
- D. Used only on units equipped with phase inversion.
- E. Used only on units equipped with voltage selection.
- F. Used only on units equipped with delatch relay.
- G. May be omitted.
- H. Used on isolated units only.



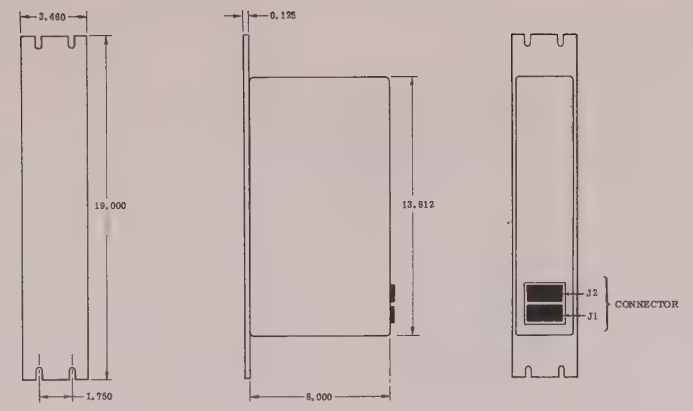


Figure 2-1. Full Rack Mounting

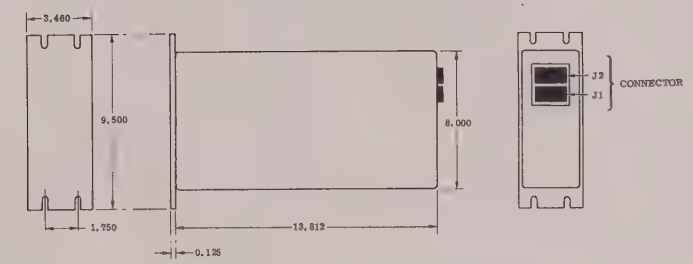


Figure 2-2. Half Rack Mounting

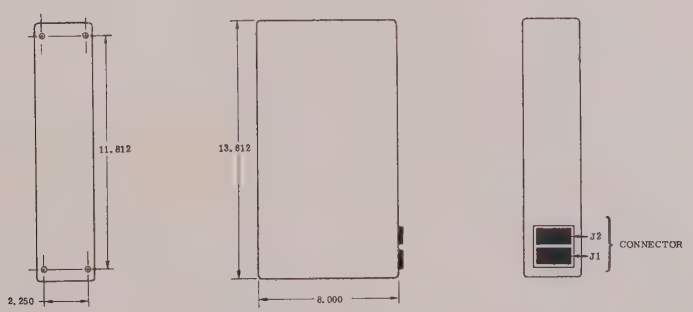


Figure 2-3. Front Mounting

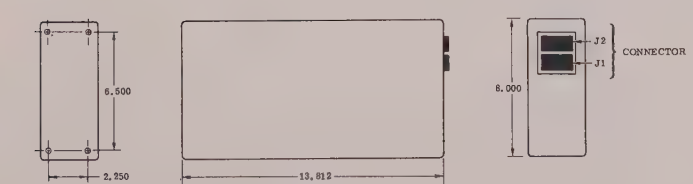


Figure 2-4. Side Mounting

SECTION III
OPERATION

3-1. GENERAL.

3-2. A typical test setup for measuring the output signals of a unit under test is shown in figure 3-1. In this application, a Gertsch Model PAV phase angle voltmeter, equipped with a meter relay, is used as a null indicator. When the two outputs are equal, the Model PAV indicates a null and the "GO" indicator is lit. If the output voltage of the unit under test varies from the output voltage ratio of the ratio transformer, the Model PAV detects an error voltage. When the error voltage exceeds a preset amount, the "NO GO" indicator is lit. A null indicator, such as a Gertsch Model NI-2, NI-3, or NI-4, may also be used for this application but without the "GO" - "NO GO" capability.

3-3. A typical digital-to-analog application is shown in figure 3-2. In this application, the RatioTran receives a parallel bit code input from the digital system. The PRT converts the system reference voltage input to a ratio voltage output. This output voltage is used to position the servo system.

3-4. Additional applications are included in the Engineering Bulletins which are appended to this instruction book.

3-5. CAUTION NOTES.

1. Make certain the input voltage does not exceed the voltage rating of the unit: 0.35 times the frequency (in HZ) or 350 vrms, whichever is less.

2. Make certain the input voltage does not contain a dc component. DC currents of more than a few microamperes will cause saturation of the input winding. If dc voltage is accidentally applied to the unit, degauss the input winding as outlined in the maintenance section.

3. Do not apply voltage across the output terminals. The voltage may be stepped up to an amount that exceeds the voltage rating of the unit.

3-6. OPERATION.

3-7. To operate the unit, proceed as follows:

a. Turn input voltage source on.

b. Turn command line voltage source on. Until a closure (ground) is furnished on one of the command lines, the output of the unit is zero.

c. Apply closures to the command lines associated with a required output ratio.

3-8. SPECIAL NOTES.

3-9. DECADE UNITS. If any decade receives an impossible command (any bit sum greater than 10), a nonsense ratio appears on the output. The nonsense ratio is 8 less than the programmed command.

Example: 8+4+2+1=15 command. 15-8=7, the output ratio.

3-10. OCTAL UNITS. To determine the bit lines associated with a required ratio, proceed as follows:

a. Select the 1, 2, 3 bit ratio closest to, but less than, the required ratio (see Table 3-1).

b. Subtract the 1, 2, 3 bit ratio from the required ratio.

c. Set the 4, 5, 6 bit ratio closest to, but less than, the difference ratio of step b.

d. Proceed with steps b and c for the 7, 8, 9, the 10, 11, 12, the 13, 14, 15, the 16, 17, 18 octals.

EXAMPLE:

1. 0.3457 is the desired ratio.
2. 0.250 is the 1, 2, 3 bit ratio closest to the required ratio therefore energize pin C.
3. 0.3457 - 0.250 = 0.0957.
4. 0.09375 is the 4, 5, 6 bit ratio closest to the difference therefore energize pins F and H.
5. 0.0957 - 0.09375 = 0.00195.
6. 0.000000 is the 7, 8, 9 bit ratio closest to the difference therefore none of the 7, 8, 9 bit pins should be energized.
7. 0.00170898 is the 10, 11, 12 bit closest to 0.00195 therefore energize pins R, S, and T.
8. 0.00195 - 0.00170898 = 0.00024102.
9. 0.00021363 is the 13, 14, 15 bit closest to 0.00024102 therefore energize pins V, W, and X.
10. 0.00024102 - 0.00021363 = 0.00002739.
11. 0.00002670 is the 16, 17, 18 bit closest to 0.00002739 therefore energize pins Z, AA, and BB.
12. 0.00002739 - 0.00002670 = 0.00000069.
13. With pins C, F, H, R, S, T, V, W, X, Z, AA, and BB energized, the output ratio of the unit is 0.34569931.

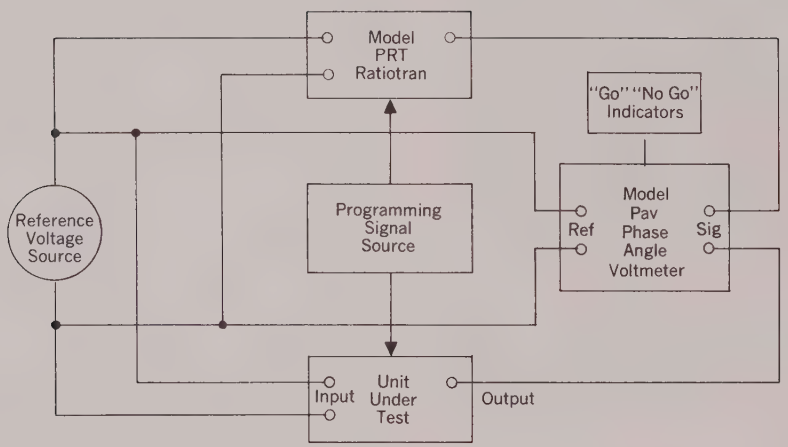


Figure 3-1. Typical Test Setup

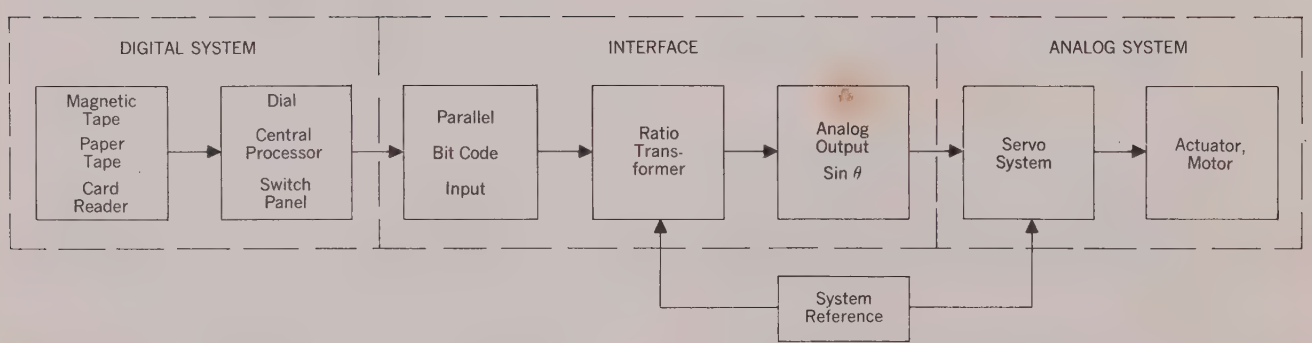


Figure 3-2. Typical Digital-To-Analog Application

TABLE 3-1. BINARY RATIO TABLE

OCTAL SETTING	1 2 3	4 5 6	7 8 9	10 11 12	13 14 15	16 17 18
	B C F	F H J	L M N	R S T	V W X	Z AA BB
.111	.875	.109375	.01367187	.00170898	.00021363	.00002670
.110	.750	.093750	.01171875	.00146484	.00018311	.00002289
.101	.625	.078125	.00976562	.00122070	.00015259	.00001907
.100	.500	.062500	.00781250	.00097656	.00012207	.00001526
.011	.375	.046875	.00585937	.00073242	.00009156	.00001144
.010	.250	.031250	.00390625	.00048828	.00006104	.00000763
.001	.125	.015625	.00195312	.00024414	.00003052	.00000381
.000	.000	.000000	.00000000	.00000000	.00000000	.00000000

NOTES:

1. The table is arranged by octals.
2. The numbers in the OCTAL SETTING column indicate the condition of the bit relays for the applicable octal.

   1 = energized or on
   0 = de-energized or off

3. The output ratio is the sum of all octal ratios.

3-11. LATCHING. The following functions apply to ratio selection, phaser inversion, and voltage selection:

a. No latching, no delatch relay. For these units, a continuous closure must be supplied to the bit lines. The relays open when the closure is broken.

b. Latching, no delatch relay. For these units, the bit relays may be programmed with a momentary closure. To delatch the relays, open the bit lines and the latching source.

c. Latching, delatch relay. For these units, the bit relays may be programmed with a momentary closure. To delatch the relays, supply a closure to pin EE.

3-12. PHASE INVERSION. If the unit is equipped with phase inversion, the output is in phase until a closure is supplied to pin CC. The output is inverted (180°) when a closure is supplied to pin CC.

3-13. VOLTAGE SELECTION. If the unit is equipped with voltage selection, the output is the first voltage (E1) until a closure is supplied to pin DD. The voltage is changed to (E2) when a closure is supplied to pin DD.

3-14. INDICATOR CONNECTIONS. The indicator connector J2 provides for a remote readout of the unit settings. The unit supplies the programming voltage for a bit indicator light or readout as shown in figure 4-13.

SECTION IV
THEORY OF OPERATION

4-1. GENERAL.

4-2. The RatioTran consists of a transformer winding for each decade or octal and control relays. Each winding provides precise portions of the input voltage. The portions are selected by the relays and added together to form the output voltage.

4-3. The windings are interconnected so that all windings are effectively on one core. The voltage on each section of a winding is equal to the voltage on any other section of the same winding. The voltage on a section of a winding is one-tenth the voltage on a section of the preceeding winding.

4-5. DECADE UNITS. (See figures 4-1, 4-2, and 4-3.)

4-6. BCD programming is used and four numbered bit lines per decade are provided. The numbers of the selected tap is the sum of the numbers for the energized bit lines. For example, tap 7 is selected when the No. 1, No. 2, and No. 4 bit lines are energized.

4-7. OCTAL UNITS. (See figures 4-4, 4-5, and 4-6.)

4-8. Straight binary programming is used and three numbered bit lines per octal are provided. As with the decade units, the number of the selected tap is the sum of the numbers for the energized bit lines.

4-9. SPECIAL FEATURES.

4-10. The various input circuits are shown in figures 4-7 through 4-12.

a. Figure 4-7 shows a direct input. The input voltage is placed directly across the first octal or decade winding.

b. Figure 4-8 shows an isolated input without phase reversal. The secondary of the isolation transformer functions as the first octal or decade winding.

c. Figure 4-9 shows an isolated input with phase reversal. The phase reversal relay, shown in figure 4-10, inverts the input voltage when energized.

d. Figure 4-12 shows an isolated input with phase reversal and voltage stepdown. The phase reversal relay, shown in figure 4-10, inverts the input voltage when energized. The voltage selection relay selects 9 stepdown voltage when energized. All programmed voltages then relate to the stepdown voltage instead of the input voltage.

4-11. LATCHING. (See figure 4-13.)

4-12. The various latching configurations and interconnections are shown in figure 4-13.

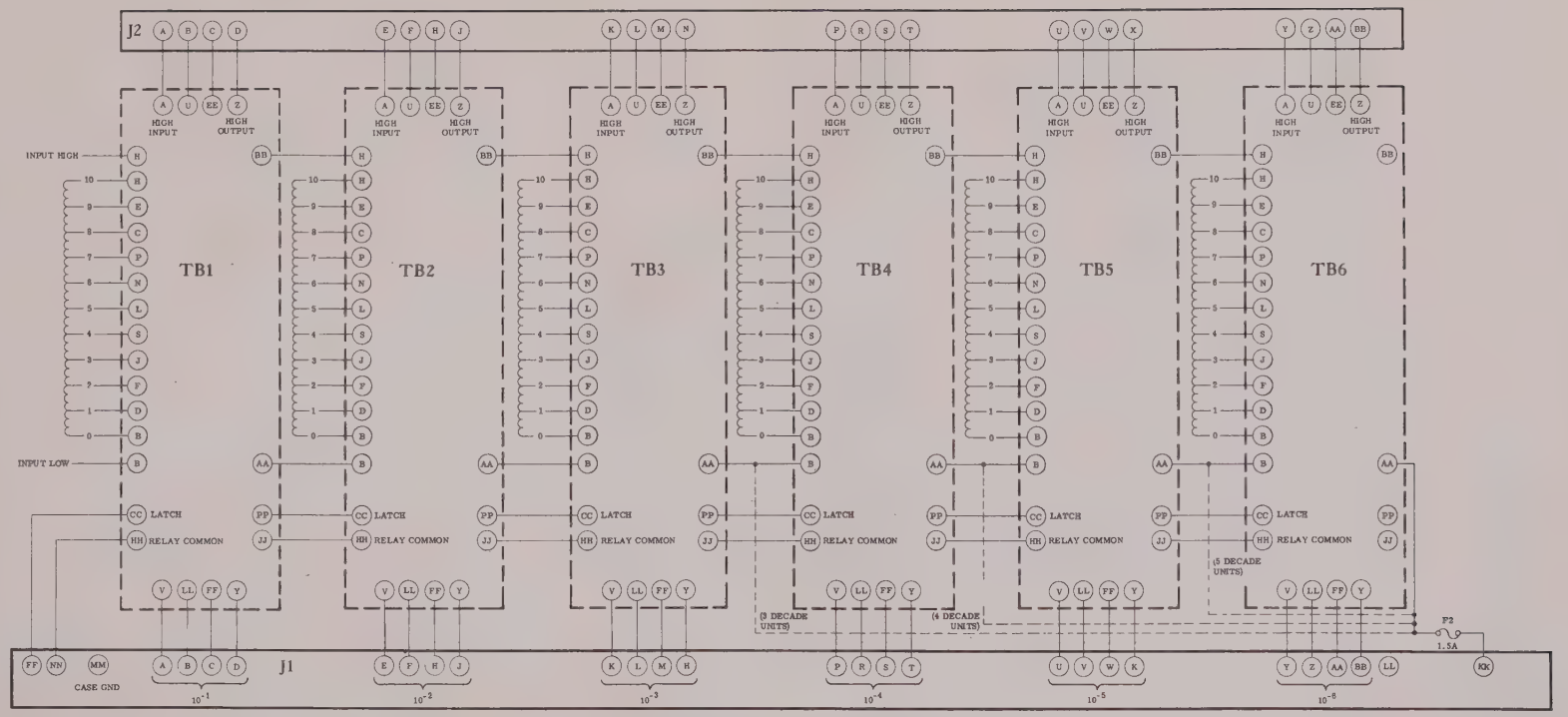


Figure 4-1. Interconnection Diagram, Decade Units

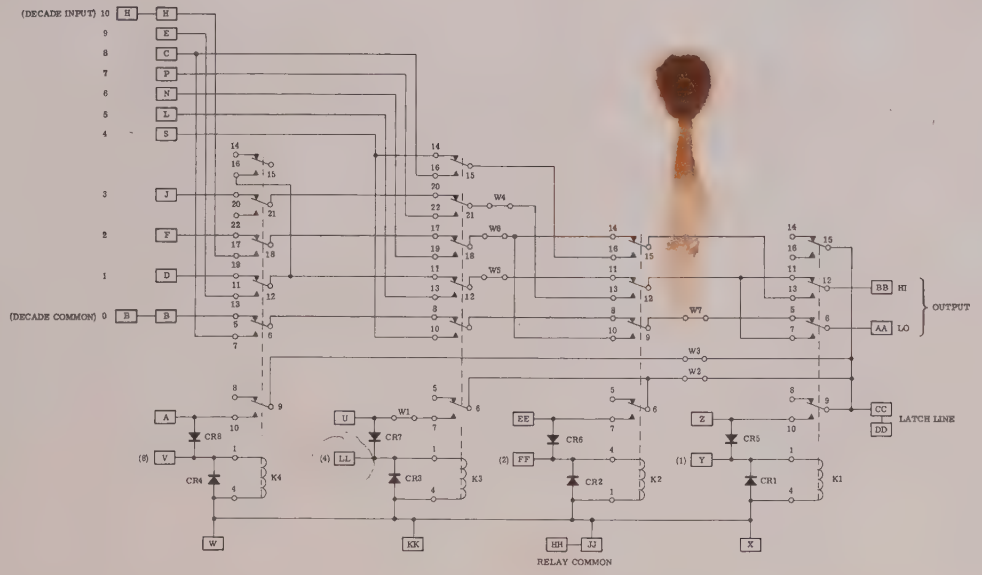


Figure 4-2. Schematic Diagram, Decade Unit Terminal Board

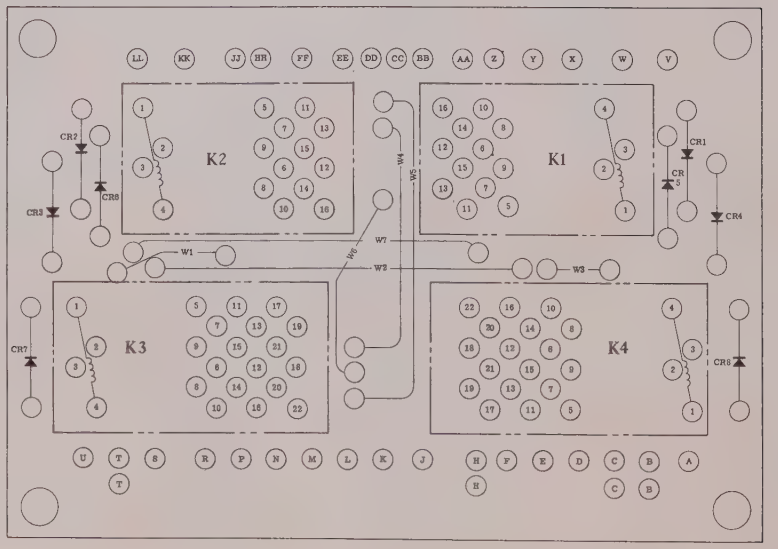


Figure 4-3. Layout of Parts, Decade Unit Terminal Board

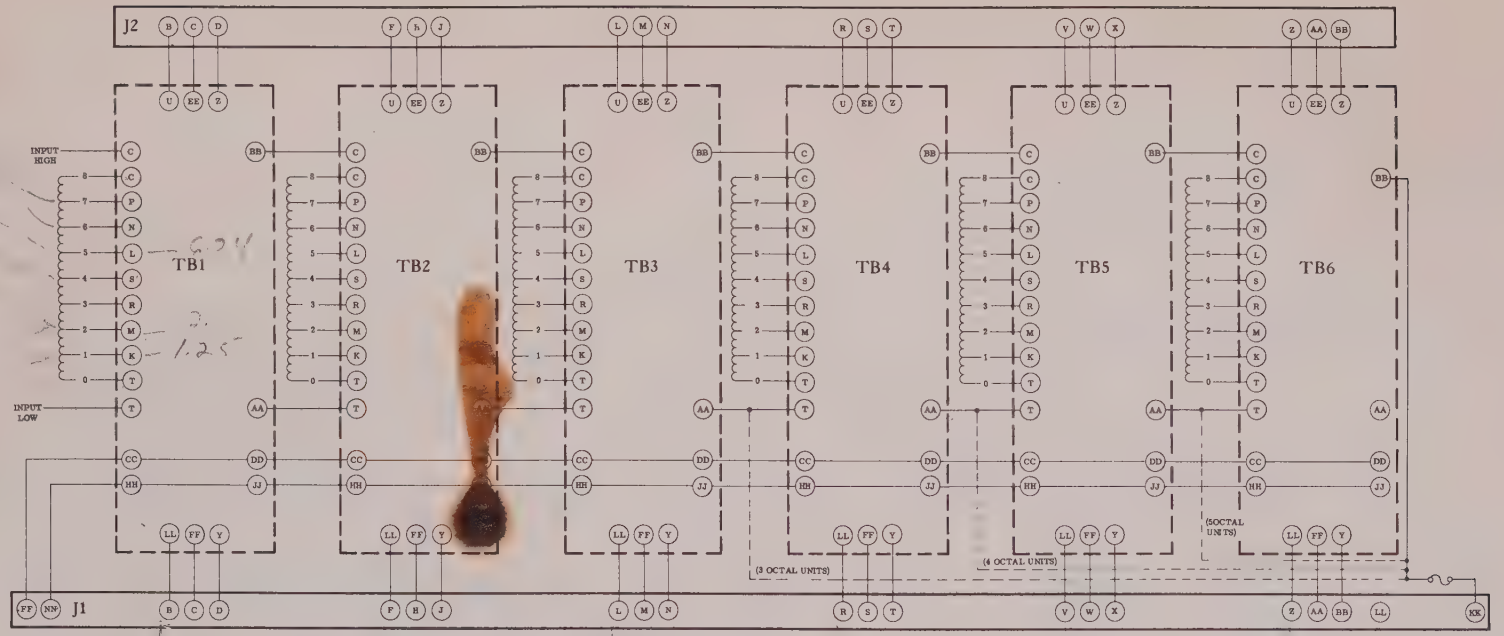


Figure 4-4. Interconnection Diagram, Octal Units

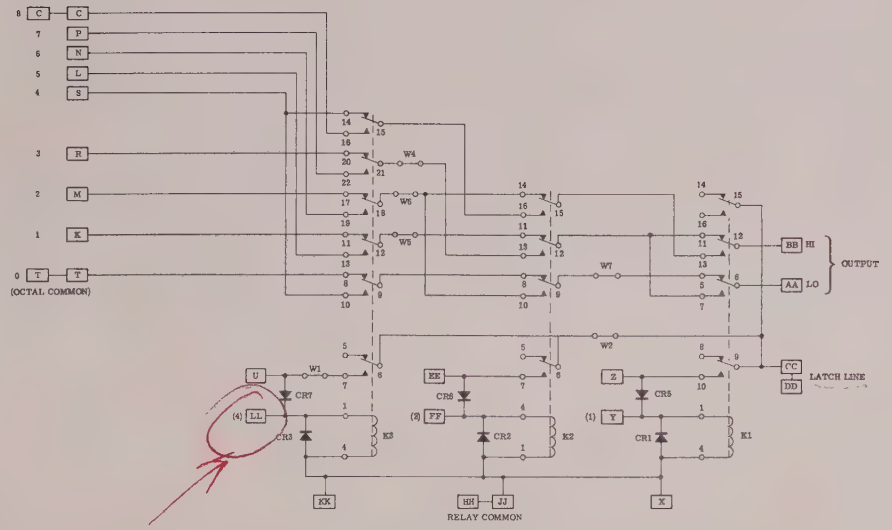


Figure 4-5. Schematic Diagram, Octal Unit Terminal Board

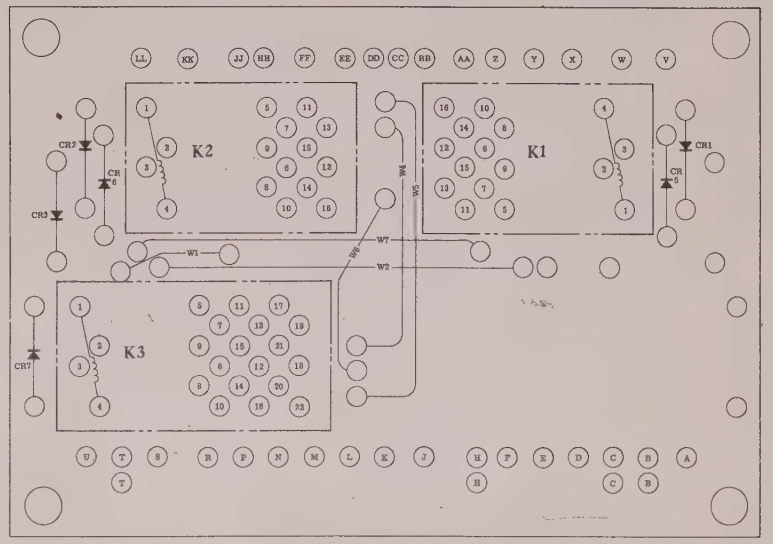


Figure 4-6. Layout of Parts, Octal Unit Terminal Board

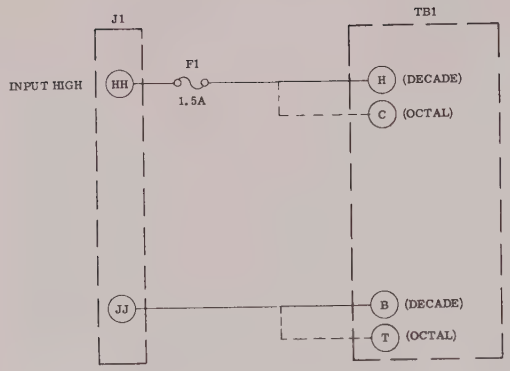


Figure 4-7. Direct Input

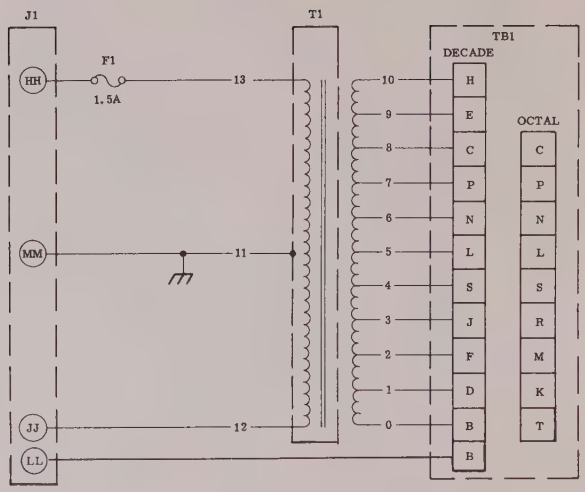


Figure 4-8. Isolated Input

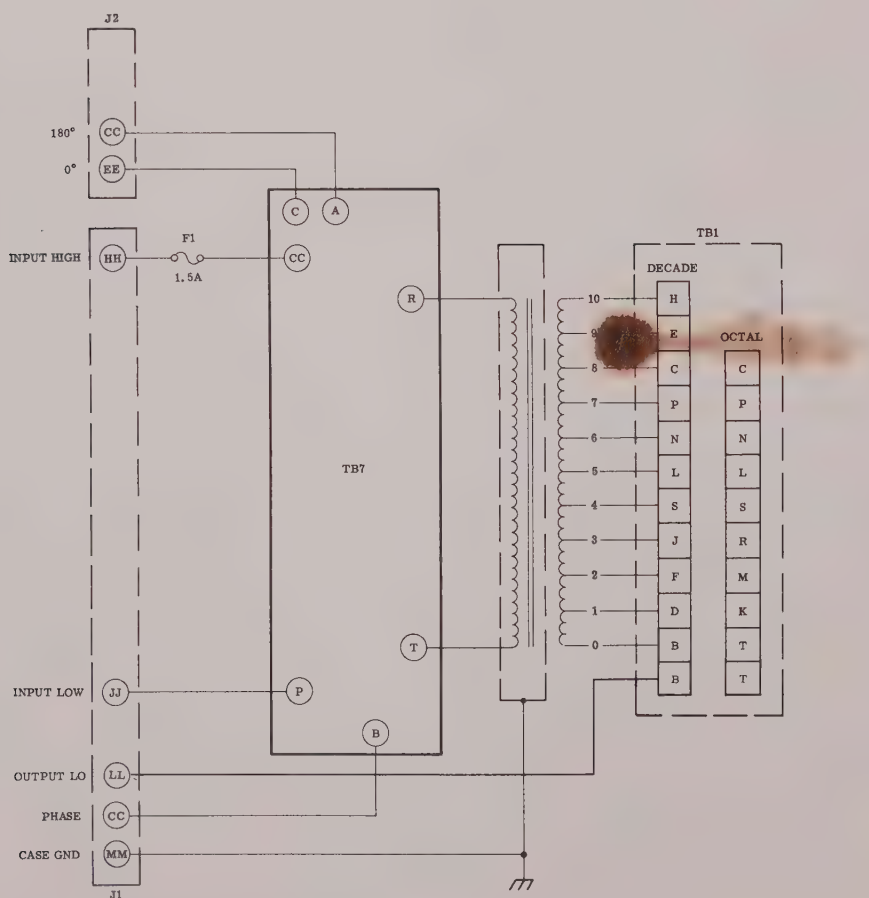


Figure 4-9. Interconnection Diagram, Phase Inversion

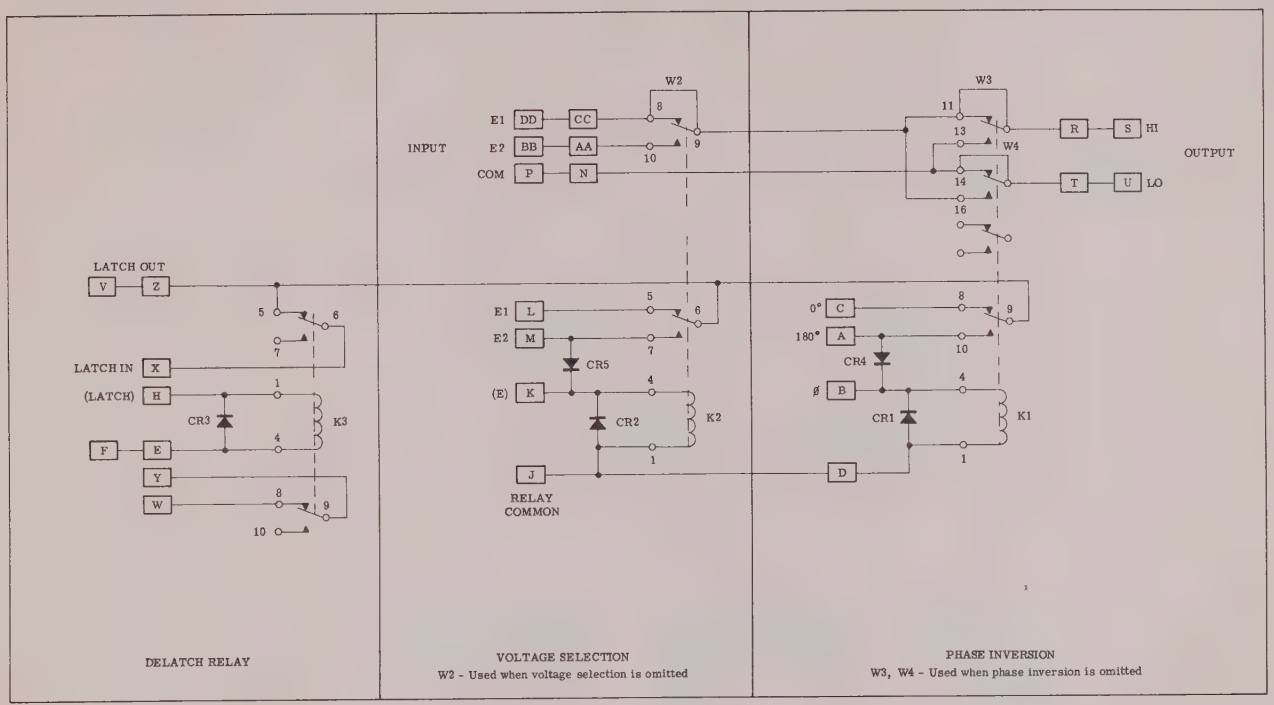


Figure 4-10. Schematic Diagram, Terminal Board TB7

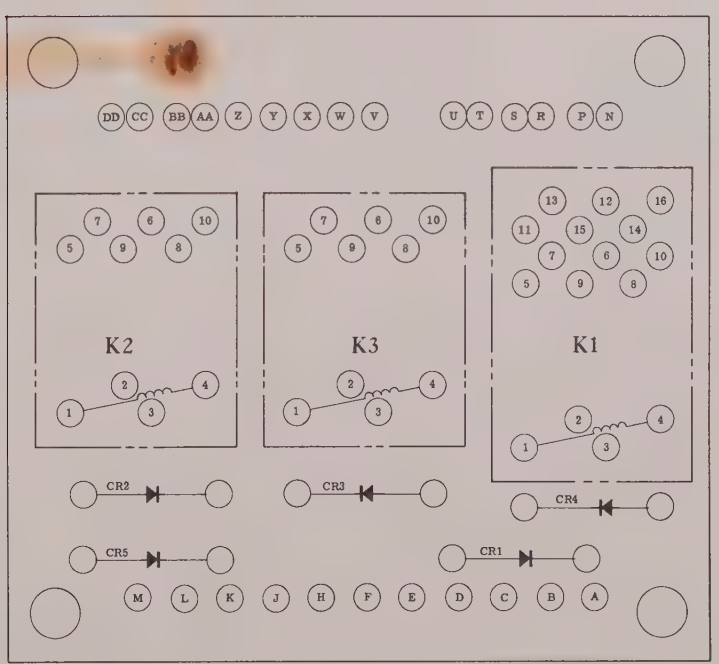


Figure 4-11. Layout of Parts, Terminal Board TB7

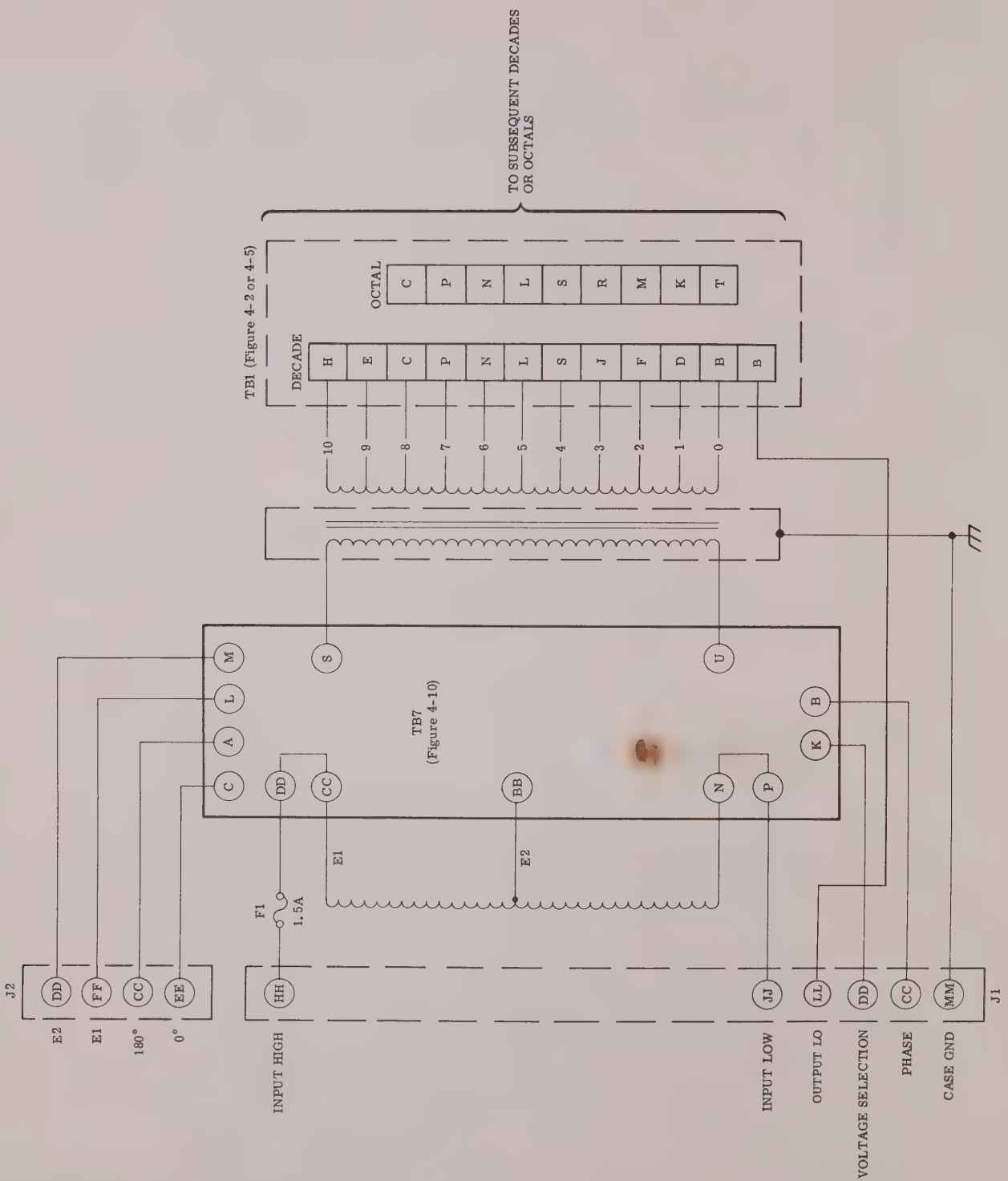

TO SUBSEQUENT DECADES OR OCTALS
TB1 (Figure 4-2 or 4-5)
DECADE
H E C P N L S J F D B B
OCTAL
C P N L S R M K T
10 9 8 7 6 5 4 3 2 1 0
TB7 (Figure 4-10)
M L A C S U B K DD CC BB N P
E1
E2
F1 1.5A
J2
DD FF CC EE
E2 E1 180° 0°
HH JJ LL DD CC MM J1
INPUT HIGH
INPUT LOW
OUTPUT LO
VOLTAGE SELECTION
PHASE
CASE GND

Figure 4-12. Schematic Diagram, Phase Inversion and Voltage Selection

Figure 4-13. Latching Variations

SECTION V
MAINTENANCE

5-1. GENERAL.

5-2. Since the RatioTrans are passive devices, a minimum of maintenance is required. No maintenance on a regularly scheduled basis is required.

5-3. DEGAUSSING.

5-4. To degauss the unit, proceed as follows:

a. Connect a 1K resistor in series with the input connection.

b. By means of a variac or other suitable voltage control, apply a 60 HZ signal between the open end of the 1K resistor and the common terminal.

c. Starting with the voltage control at zero, increase voltage to 40 vrms.

d. Slowly decrease the voltage to zero. The period of time to reduce the voltage from 40 vrms to zero should be between 10 and 15 seconds.

5-5. REPAIRS.

5-6. If any repairs are made on the unit or if any parts are replaced, check accuracy as outlined in Section VI. If any transformer problems are encountered, it is recommended that the unit be returned to the factory for overhaul and recalibration.

5-7. DISASSEMBLY AND REASSEMBLY.

5-8. To gain access to parts, remove the top cover which is attached with six screws. No special sequence is required for further disassembly.

5-9. TROUBLE SHOOTING.

5-10. To isolate troubles, perform calibration procedure as outlined in Section VI. Refer to the schematic diagrams to determine the parts associated with a specific ratio.

SECTION VI
CALIBRATION

6-1. GENERAL.

6-2. The accuracy of the unit is dependent primarily on relay contact life of 1 million operations. A calibration check every 100,000 operations or every three years (whichever comes first) is recommended.

6-3. If the unit is used to measure six ratios per minute for six hours per day, the unit will operate 2,160 times per day. Under these conditions, a calibration check every 50 working days is recommended.

6-4. The calibration procedure consists of two tests: an input impedance test and a ratio accuracy test. Refer to Table 6-1 for a list of test equipment required. For a field test of the unit, any ratio transformer may be substituted for the Model 1011 AC Ratio Standard.

6-5. IMPEDANCE CHECK.

6-6. To check input impedance proceed as follows:

a. Connect unit into test setup as shown in figure 6-1.

b. Set input frequency to 400 HZ.

c. Adjust voltage source until VTVM V1 indicates 40 vrms (or more).

d. Adjust decade resistance box until VTVM V2 shows equal indications with switch SW-1 in either position A or B.

e. Read input impedance from the decade resistance box. The input impedance shall be 150K or more.

6-7. RATIO ACCURACY TEST.

6-8. To test the ratio accuracy proceed as follows:

a. Connect unit into test setup as shown in figure 6-2.

b. Set input frequency to 400 HZ.

c. Apply input voltage of 115 vac as indicated on VTVM V1.

d. Set RT standard controls for an output reading of 0.000000.

e. Adjust RatioTran control relays until the null indicator indicates a null.

f. Check the ratio indicated by the unit under test against the ratio indicated by the RT standard unit. The two ratios shall agree within ± 2 ppm.

g. For the decade units, repeat steps e through g for each switch position of the RT standard unit (0.11111, 0.22222, etc.).

h. For the octal units, refer to Table 3-1 for the binary ratios.

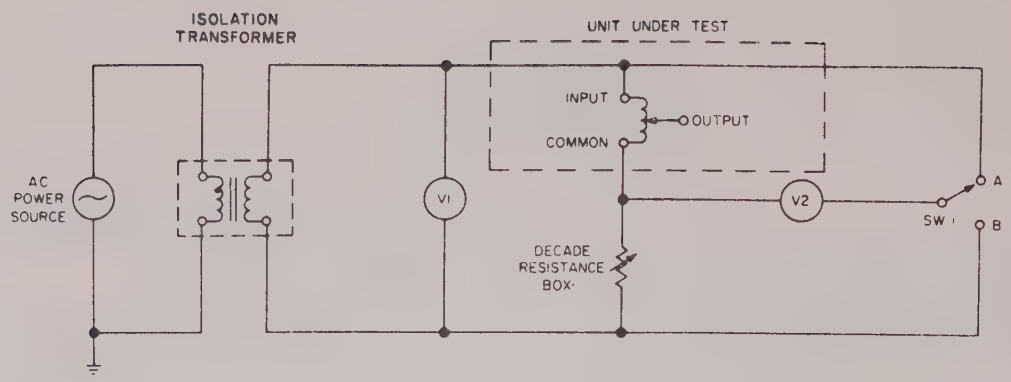


Figure 6-1. Impedance Test Setup

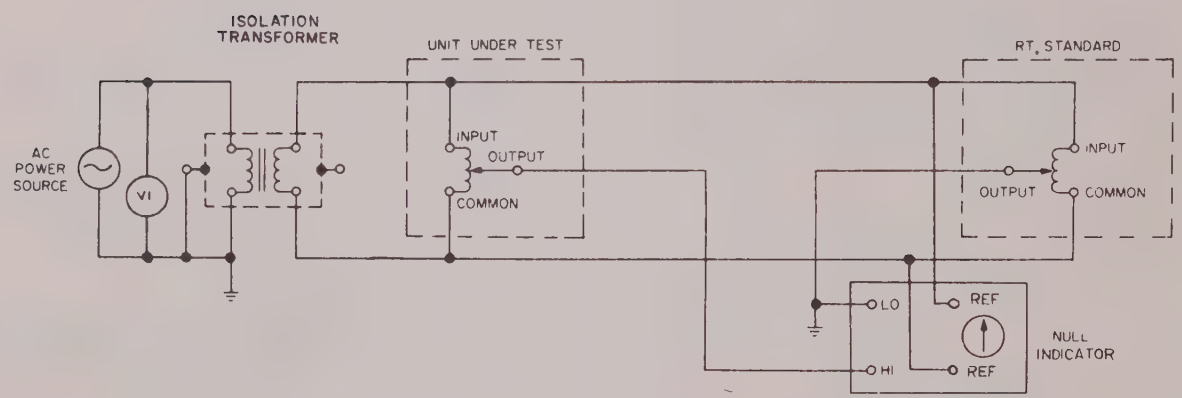


Figure 6-2. Ratio Accuracy Test

TABLE 6-1. LIST OF TEST EQUIPMENT

NOMENCLATURE	PART NUMBER OR MODEL	APPLICATION	RANGE	ACCURACY
AC Ratio Standard	Model 1011 (Singer Metrics)	Provides comparison standard for ratio test	1.111111 to -0.111111 ratios	Per National Bureau of Standards Calibration Test
Bridge Transformer	Model ST248 (Singer Metrics)	Provides signal isolation	120 vac, 400 HZ (maximum)	
Null Indicator	Model NI-3 (Singer Metrics)	Provides means of comparing output voltage		
Decade Resistance Box		Provides voltage divider network	1 megohm range	±0.5%
Vacuum Tube Voltmeter	Model 410B (Hewlett-Packard)	Measuring voltages		±5%
Switch		Check voltage divider network	SPDT	

SECTION VII
PARTS LIST

	ITEM	PART NO.	MANUFACTURER
1	Connector, J1	MRE-34P-J6	Winchester
2	Connector, J2	MRE-34S-J6	Winchester
3	Fuse, 1.5 amp, F1 and F2	MDL 1-1/2	Littelfuse
4	Fuseblock	3795	Bussman
5	Terminal Board Assembly (TB1 through TB6, Decade Units)	AA-1310-*	Singer
5.1	Diode (CR1 through CR8)	1N4148	
5.2	Relay (K1 and K2)	R10-E1-Z4	Parelco
5.3	Relay (K3 and K4)	R10-E1-Z6	Parleco
6	Terminal Board Assembly (TB1 through TB6, Octal Units)	AA-1310-*	Singer
6.1	Diode (CR1 through CR7)	1N4148	
6.2	Relay (K1 and K2)	R10-E1-Z4	Parelco
6.3	Relay (K3)	R10-E1-Z6	Parelco
7	Terminal Board Assembly (TB7)	AA-1309-*	Singer
7.1	Diode (CR1 through CR5)	1N4148	
7.2	Relay (K1)	R10-E1-Z4	Parelco
7.3	Relay (K2 and K3)	R10-E1-Z2	Parelco
8	Transformer Assembly (PRT-0-30020)	1-002439-001	Singer
	Transformer Assembly (PRT-D-50022)	1-002440-001	Singer

*Basic part number, dash numbers vary with D.C. voltage polarity latching, and special features requirements.

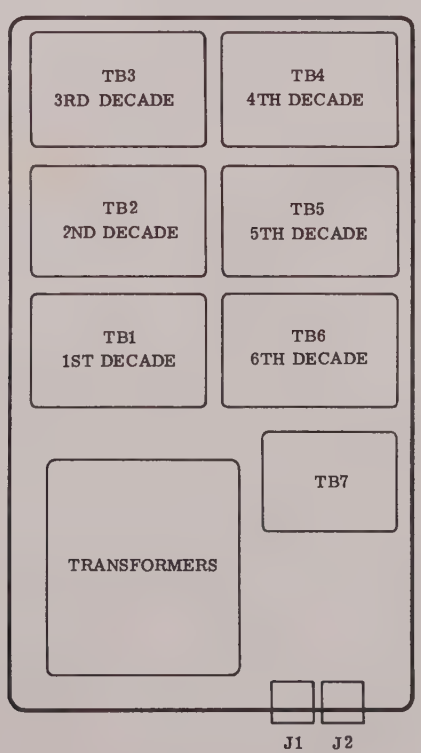


Figure 7-1. Layout of Parts

ADDENDUM

For
Manual No. 500783-007 (Rev. A)
Model No. PRT Series

Effective Date: August 7, 1972

Perform the following additions or deletions to the above manual:

Page 1-1 Table 1-1 Specifications

Relay Data

Operating Voltage	was: 22-31 Vdc	is: 22-40 Vdc
Impedance	was: 430 ohms	is: 2500 ohms
Current/Bit	was: 62 mA (max)	is: 10 mA (max)
Drop Out	was: 1.8 V (min)	is: 1.4 V (min)

Page 7-1/7-2

5.2 Relay (K1 and K2)	was: R10-E1-Z4	is: R10-E1-Z4-J2.5K
5.3 Relay (K3 and K4)	was: R10-E1-Z6	is: R10-E1-Z6-J2.5K
6.2 Relay (K1 and K2)	was: R10-E1-Z4	is: R10-E1-Z4-J2.5K
6.3 Relay (K3)	was: R10-E1-Z6	is: R10-E1-Z6-J2.5K
7.2 Relay (K1)	was: R10-E1-Z4	is: R10-E1-Z4-J2.5K
7.3 Relay (K2 and K3)	was: R10-E1-Z2	is: R10-E1-Z2-J2.5K

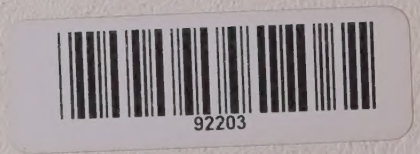
REVISED

APPROVED 12-12-72

SINGER
INSTRUMENTATION
LOS ANGELES, CALIF.

TITLE ADDENDUM
MODEL PRT SERIES

DWG NO. I- 500783-007(1)
SHEET 1 OF 1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